Lingcod Tagging Study in the Strait of Georgia, November 1982 - March 1983

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LINGCOD TAGGING STUDY IN THE STRAIT OF GEORGIA, NOVEMBER 1982-MARCH 1983

by

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ABSTRACT

Cass, A. J., G. A. McFarlane, K. Rutherford and I. Barber. 1984. Lingcod tagging study in the Strait of Georgia, November 1982-March 1983. Can. MS Rep. Fish. Aquat. Sci. 1791: 49 p.

Lingcod tagging studies were conducted during November 4, 1982-March 11, 1983 in the Strait of Georgia. The purpose of the study is to estimate survival, abundance and exploitation and to examine stock distribution. This report describes the methods and results of the first year of a proposed 3-yr study.

Tagging was conducted in the Campbell River, Stuart Island and Pender Harbour areas. A total of 3991 lingcod were tagged; 3054 (76%) in the Campbell River area, 304 (8%) in the Stuart Island area and 633 (16%) in the Pender Harbour area. A random sample of 394 (10%) were double-tagged to estimate tag loss. Random samples of 222 tagged lingcod in the Campbell River area were sampled for age and 281 were injected with oxytetracycline (OTC) for age validation purposes.

The mean length of male and female lingcod increased with depth. Males predominated at shallow depths. Females predominated on deep offshore reefs.

Male lingcod sampled for age ranged from 1-11 yr. Females ranged from 2-13 yr. Modal ages ranged from 3-4 yr for males and 4-5 yr for females. Growth increased almost linearly to age 7 and declined thereafter. Males increased an average of 4.3 cm/yr and females increased an average of 6.4 cm/yr in fork length over the period of linear growth.

Except for lingcod hooked in the gill area or throat, there was no mortality of tagged lingcod while they were held in recovery tanks. Losses from improper hooking were estimated to be less than 1%.

The rates of comparable OTC-injected and uninjected recoveries were similar, indicating short-term mortality from the dosages used (25 mg/kg) in this study was negligible. Similarly, the recovery rates of releases sampled for age were similar to recovery rates of tag releases that were not sampled.

A total of 392 tag recaptures was reported by sports (15%) and commercial (85%) fishermen during the 1983 fishing season. The sports and commercial fisheries appear to impact upon different sizes of lingcod with sports fishermen catching smaller fish. The large disparity between the proportions of tag recaptures in the sports and commercial fisheries can, in part, be explained by the fact that a disproportionally large number of tagged lingcod were larger size lingcod.

Tag losses occurred at both the primary and secondary tag site. Of the 61 double-tagged lingcod recovered, 7 (11.5%) lost tags at the primary tag site and 6 (9.8%) lost tags at the secondary site.

Abundance was estimated for a portion of the Campbell River area using multiple census techniques. For combined sexes, the Schumacher and Eschmeyer estimate was 10,300 lingcod (95% C.L.=9,500-11,300) and the Schnabel estimate was 10,000 lingcod (95%C.L.=8,900-11,300).

RÉSUMÉ

Cass, A. J., G. A. McFarlane, K. Rutherford and I. Barber. 1984. Lingcod tagging study in the Strait of Georgia, November 1982-March 1983. Can. MS Rep. Fish. Aquat. Sci. 1791: 49 p.

Du 4 novembre 1982 au 11 mars 1983, on a effectué des études d'étiquetage de la morue-lingue dans le détroit de Géorgie afin d'établir des données estimatives de survie, d'abondance et d'exploitation et d'examiner la répartition du stock. Le présent rapport porte sur les méthodes utilisées et les résultats obtenus au cours de la première année d'une étude triennale.

L'étiquetage a été effectué dans les régions de la rivière Campbell, de l'île Stuart et de Pender Harbour. Au total, 3991 morues-lingues ont été étiquetées selon le schème suivant: 3054 (76%) dans la rivère Campbell, 304 (8%) dans la région de l'île Stuart et 633 (16%) dans le secteur de Pender Harbour. Afin d'évaluer la perte d'étiquette, un échantillon aléatoire composé de 394 (10%) spécimens a reçu deux étiquettes. Dans la rivière Campbell, on a déterminé l'âge d'un échantillon aléatoire de 222 spécimens étiquetés et l'on a injecté de l'oxytétracycline (OTC) à 281 individus pour la validation des âges.

La longueur moyenne des mâles et des femelles augmentait en fonction de la profondeur. Les mâles étaient plus abondants dans les eaux peu profondes tandis que les femelles l'emportaient sur les bancs hauturiers profonds.

Les poissons échantillonnés pour la détermination de l'âge avaient de 1 à 11 ans, dans le cas des mâles, et de 2 à 13 ans, pour ce qui est des femelles. L'âge modal allait de 3 à 4 ans chez les premiers et de 4 à 5 ans chez les secondes. Jusqu'à 7 ans, la croissance augmentait d'une façon presque linéaire et baissait par la suite. Pour ce qui est de la longueur à la fourche, elle augmentait en moyenne de 4.3 cm par année chez le mâle et de 6.4 cm par année chez la femelle au cours de la période de croissance linéaire.

Sauf pour les morues-lingues hameçonnées dans la région des ouïes ou de la gorge, aucun spécimen étiqueté n'est mort pendant la retenue dans les bacs de récupération. On évalue les pertes par capture incorrecte à moins de 1%.

Les taux de récupération comparable de poissons injectés ou non d'OTC ont été semblables, ce qui porte à croire que la mortalité à court terme entraînée par les doses utilisées (25 mg/kg) au cours de cette étude a été

négligeable. De même, les taux de récupération des poissons échantillonnés pour la détermination de l'âge se comparaient à ceux des poissons étiquetés mais non échantillonnés.

Au total, 392 poissons étiquetés ont été capturés par des pêcheurs sportifs (15%) et commerciaux (85%) pendant la saison de pêche de 1983. Il semble que l'incidence de la pêche commerciale et celle de la pêche sportive varient selon la taille de la morue-lingue, le pêcheur sportif capturant plus de petits poissons. On peut donc expliquer en partie la différence marquée entre les proportions de récupération des étiquettes dans ces deux secteurs par le fait qu'un nombre disproportionné des morues-lingues étiquetées étaient de grande taille.

La perte d'étiquettes a eu lieu aux sites d'étiquetage primaire et secondaire. Des 61 morues-lingues recapturées portant deux étiquettes, 7 (11.5%) ont perdu l'étiquette fixée au site primaire et 6 (9.8%), au site secondaire.

À l'aide de techniques de recensement multiple, on a déterminé l'abondance des poissons dans une partie de la rivière Campbell. Selon les estimations de Schumacher et Eschmeyer, l'abondance (sexes combinés) s'élevait à 10,300 morues-lingues (L.C. à 95% = 9,500 - 11,300) et selon celle de Schnabel, à 10,000 poissons (L.C. à 95% = 8,900 - 11,300).

INTRODUCTION

The commercial fishery for lingcod in the Strait of Georgia has been well established since the early 1900s. The sports fishery developed more recently and is currently responsible for significant catches of lingcod in the Strait of Georgia. Despite the extent of exploitation by fisheries in the Strait of Georgia, data collection and analysis has not been particularly well developed.

In the absence of a suitable historical data base of fisheries and biological statistics, mark-recapture experiments were initiated in 1982 to estimate survival, abundance and exploitation and to examine stock distribution in key areas of the Strait of Georgia.

This report describes the methods and results of the first year of a proposed 3-year study.

METHODS

SITE SELECTION

Sales records of commercial lingcod landings (Anon. 1982a) and results of the 1980-81 creel survey of the sports fishery (Anon. 1982b) were used to identify key lingcod fishing areas in the Strait of Georgia. Three sites having comparatively high levels of catch and fishing effort were selected for tagging operations, namely the Campbell River, Stuart Island, and Pender Harbour areas (Fig. 1).

Tagging in the Campbell River area was conducted throughout Discovery Passage northward from Campbell River to Chatham Point and in the more exposed regions adjacent to Cape Mudge, Willow Point and Shelter Point. Tagging in the Stuart Island area was conducted in the nearshore waters between Sonora Island and Stuart Island. Tagging in the Pender Harbour area was conducted in the southern portion of Malaspina Strait from Egmont to Welcome Pass.

Tagging period

Tagging was mainly conducted during the lingcod fishing closure (November 15-April 15). This was done for three reasons. First, to prevent the recapture of tagged fish by sports and commercial fishermen immediately upon their release, thereby allowing time for tagged lingcod to become randomly distributed with untagged stock components. Second, to allow us to use tag recovery data collected while tagging to estimate abundance without making assumptions about non-reporting rates in the sports and

commercial fisheries. Third, to maximize our fishing effort by tagging during the more vulnerable winter pre-spawning, spawning and nesting periods.

Tagging was conducted in the Campbell River area, the principal tagging site, from November 4, 1982 to March 12, 1983. Tagging in the Stuart Island and Pender Harbour areas was conducted during January 18 to February 18 and January 4 to February 24, 1983, respectively.

Fishing methods

Tagging was conducted from chartered commercial fishing vessels. Vessels were selected based on the skipper's experience and knowledge of the local distribution of lingcod in each of the three tagging areas.

In the Campbell River area, two vessels were selected for a total of 84 days. The 12 m M/V ARRAN TIDE was chartered for 9 d and the 12 m M/V MISS QUADRA was chartered for 75 d. In the Stuart Island area, the 12 m M/V FRASER BELLE was chartered for a total of 13 d. In the Pender Harbour area, the 12 m M/V BREAKAWAY was chartered for 25 d.

Lingcod were caught using hooks baited with live herring. Within each tagging area an attempt was made to distribute fishing effort over as large an area as possible given time and effort constraints. Individual tagging locations were selected on the basis of the vessel skipper's prior knowledge of the distribution of lingcod. An attempt was made to tag lingcod throughout the range of length and age classes present within each tagging site. Fishing was conducted at depths ranging from 9-64 m.

Tagging methods

Lingcod were tagged using a yellow Floy FD-68 anchor tag. Each tag was number coded (e.g. B8200000) for identification and contained the following message: Reward Pacific Biological Station. The tag was positioned in the connective tissue matrix just below the base of the dorsal fin. All lingcod were tagged just below the base of the anterior portion of the first dorsal fin (primary tag site). A random sample of 9.9% of all tag releases also received a second anchor tag just below the base of the posterior portion of the first dorsal fin (secondary tag site) to estimate the rates of tag loss.

Sampling methods

As each lingcod was caught, care was taken to remove the hook without causing undue injury. In most cases, lingcod were hooked in the jaw or mouth. In these fish, the hooks were easily removed with no apparent damage to the fish. Lingcod hooked in the gill or throat were not tagged. Each lingcod designated for tagging was placed in a holding tank containing fresh sea water and the anaesthetic MS222 (tricaine methane sulfonate). Fresh sea water was added to the tank if respiration became excessively reduced.

Tagged lingcod were measured for fork length to the nearest millimeter. The presence of the external papillae at the anal vent in male lingcod was used to identify the sex of all tag releases. Observations on injuries and condition of each tagged fish were recorded. Prior to their release, all tagged lingcod were held in the holding tanks to recover from the anaesthetic and to assess short-term mortality from tagging-related stresses.

Age structures were removed from a random sample of 222 (9.5%) tagged lingcod caught at Campbell River during November 9-21. The 4th-6th rays of the second dorsal fin were removed and aged according to the criteria of Beamish and Chilton (1977). Lingcod sampled for age and maintained in holding tanks at the Pacific Biological Station have shown no observable long-term reaction to the removal of fin-rays and in all cases the wounds healed completely within one year.

A random sample of 281 (9.2%) of all lingcod tagged in the Campbell River area were also given intraperitoneal injections of oxytetracycline (OTC) for age validation. OTC leaves a time-mark on bony structures that fluoresces when examined under ultraviolet light. Dosages of 25 mg/kg of body weight were injected using standard liquamycin solutions. Injections were administered with 10-mL syringes equipped with a 16 g, 1.9 cm needle.

In previous tagging studies of lingcod (Cass et al. 1983b, Cass and Beamish 1983) and sablefish (Beamish et al. 1983), dosages of 100 mg/kg of OTC were administered and were a suspected cause of mortality. In more recent lingcod tagging studies (Cass et al. 1983a), dosages of 25 mg/kg of OTC resulted in a negligible difference between tag recoveries of injected and uninjected lingcod over a 5-month period. As a result, OTC dosage levels of 25 mg/kg are believed to cause negligible mortality in tagged lingcod.

The catch composition of fish other than lingcod was recorded.

Sampling of tag recaptures

Tag recaptures during the tagging period were re-released. Prior to their release in the Campbell River and Stuart Island areas, the tag number was recorded along with the date and area of recapture. All relevant tag recapture information from fish recovered by sports and commercial fisheries such as date, location, target species and fishing method, was recorded. Whole tagged fish returned from the commercial and sports fisheries were measured for fork length to the nearest millimeter, sampled for sex and maturity, and a portion of the second dorsal fin (4th-9th rays) was removed for age determination. Fins from fish injected with OTC were stored in darkness to prevent deterioration of OTC marks.

Advertising

Letters and posters describing the tagging study and offering a reward for the return of tagged fish were distributed to marinas, retail outlets, resorts, processing plants and fisheries offices throughout coastal areas of the Strait of Georgia. Aspects of the study were also published in several local newspapers in communities bordering the Strait of Georgia.

As an incentive to return tagged fish, along with information on the date and area of recapture, a reward of $3 was paid for each recovery. As a further incentive, rewards of $100 were paid for a small number of randomly selected tag returns. Commercial fishermen and processors returning tagged lingcod were also compensated for the market value when whole fish were returned.

RESULTS AND DISCUSSION

Catch rates of lingcod in the Campbell River area ranged from a weekly average of 58/d in early December to 9/d during early February. Catch rates in the Stuart Island and Pender Harbour areas were similar and ranged from 16-31 lingcod per day during the January-February tagging period. Despite the fluctuations in catch rates there was no discernible trend during the period of tagging in each of the three areas (Fig. 2).

A total of 3991 lingcod were tagged and released; 3054 (76 %) in the Campbell River area, 304 (8%) in the Stuart Island area and 633 (16%) in the Pender Harbour area. Numbers of tag releases by area and date are summarized in Table 1. Tagging release information is presented in Appendix 1.

Size and sex composition

Females accounted for 62% of all tag releases; 68% in the Campbell River area, 56% in the Stuart Island area and 40% in the Pender Harbour area. For all areas combined, females ranged in length from 46-114 cm. Males ranged in length from 36-88 cm. Length frequencies of lingcod by tagging location for each of the three tagging areas are listed in Appendix 2.

Lingcod were concentrated in discrete geographic areas throughout the depth range fished. However, there were distinct differences in the size and sex composition of lingcod by depth (Fig. 3).

In the Campbell River area, where fishing was extensive over a range of depths, the mean lengths of both males and females increased with depth. Small male and female lingcod, averaging 57 cm and 63 cm in length, respectively, were largely confined to the shallow nearshore areas opposite kelp beds in depths ranging from 5-25 m. At intermediate depths (25-40 m) males and females averaged 66 cm and 72 cm, respectively. At deeper depths (45-65 m) the average lengths of males and females increased to 71 cm and 85 cm, respectively. Males and females were largely segregated throughout the tagging period. Males predominated at shallow depths, accounting for 88% of the catch within the 5-40 m depth range. Females predominated on the deep offshore reefs, accounting for 82% of the catch within the 45-65 m depth range.

The size and sex composition of lingcod caught in the Pender Harbour area also varied by depth (Fig. 3). Smaller, predominantly male lingcod

(71%), occupied the shallow nearshore regions (<30 m) and larger, predominantly female lingcod (76%), occupied the deeper reefs(≥30 m). Mean lengths of males and females in the 5-30 m depth range was 58 and 69 cm, respectively. At depths exceeding 30 m males averaged 64 cm and females averaged 89 cm in length.

Fishing in the Stuart Island area was conducted primarily in the shallow nearshore areas (average depth = 27 m). The size composition of lingcod in the Stuart Island area was similar to other nearshore tagging areas. Mean length of males and females in the Stuart Island area was 59 cm and 64 cm, respectively. However, contrary to other nearshore areas, males comprised a smaller component of the catch and accounted for 44% of the total number tagged.

Age and growth

Female lingcod sampled for age ranged from 2-13 yr and averaged 6 yr of age. Males ranged from 1-11 yr and averaged 5 yr of age. Modal ages ranged from 3-4 yr for males and 4-5 yr for females (Table 2; Fig. 4).

Growth was examined from the relationship between length and age (Table 2; Fig. 4). Growth rates were similar to growth rates of lingcod in other studies (Cass et al. 1983a). Growth of male and female lingcod increased almost linearly to age 7 and declined slightly thereafter. Over the period of linear growth (ages 3-7) females increased an average of 6.4 cm/yr and males increased an average of 4.3 cm/yr in length.

Tagging, injection, and sampling mortality

Except for lingcod hooked in the gill area or throat, there was no mortality of tagged lingcod while they were held in recovery tanks. Many of the fish hooked in the gills or throat bled from the hook wound and in some cases died within a short period after capture. However, losses from improper hooking were estimated to be less than 1%. Commercial handline fishermen routinely keep lingcod alive in holding tanks for as long as several days with little mortality. For these reasons, we believe tagging mortality in this study is negligible. On several occasions during this study tagged lingcod were held in holding tanks overnight with no mortality.

The tag recovery rate of lingcod injected with OTC was compared to uninjected tag releases to determine the effect of OTC on mortality. A total of 29 (10.3%) injected fish were recovered. The recovery rate of comparable uninjected tag releases was 10.8%. As was found in other lingcod tagging studies (Cass et al. 1983a), these results indicate the 25 mg/kg of OTC applied in this study caused no apparent short-term mortality.

Recoveries of tag releases sampled for age were compared to unsampled releases to determine whether removal of dorsal fin-rays caused mortality to tagged lingcod. The recovery rate of tagged lingcod sampled for age was 9.5% compared to 9.1% for unsampled lingcod released during the same time period. This indicates that the removal of 2-3 fin-rays caused no apparent mortality to sampled lingcod. All tag releases sampled for age and

examined at the time of their recapture in 1983 showed visible signs of healing of the clipped portion of the fin.

Tag recoveries

Of the 3122 fish released in the Campbell River area, 344 (11%) were recaptured and re-released during the tagging study (Table 3). In the Stuart Island area only 2 (0.6%) of the 358 releases were recovered and re-released. Recaptures of tag releases in the Pender Harbour area were not recorded.

During the release period lingcod were never recaptured on the same day of their release. After one day, the frequency of recaptures increased substantially (Table 4) with 54% of the recaptures occurring within 2 weeks of their release. While it is difficult to examine the effect of tagging on fishing vulnerability, it seems that it takes at least one day for tagged lingcod to become vulnerable to fishing following their release.

A total of 392 (10%) lingcod tag recoveries were reported by commercial and sports fishermen during the 1983 fishing season (April 15-November 15). Of this amount, 327 (11%) were recovered from tag releases in the Campbell River area, 30 (10%) from releases in the Stuart Island area, and 35 (6%) from releases in the Pender Harbour area.

The proportion of tag returns by sports and commercial fishermen varied among tagging areas (Table 5). In the Campbell River area, 310 (95%) of the 327 tag recaptures were caught in the commercial fishery; 93% while fishing for lingcod. The remaining 17 lingcod (5%) were caught in the sports fishery; 88% while fishing for lingcod. In the Stuart Island area, 22 (73%) of the 30 tag returns were from the commercial fishery; 91% were caught while fishing for lingcod. Of the remaining 8 lingcod returned by sports fishermen, 7 were caught while fishing for lingcod. In the Pender Harbour area, the majority (94%) of the tag returns were recaptured by sports fishermen. Of the 35 tag recoveries from the Pender Harbour area, 26 (74%) were recaptured by sports fishermen fishing for lingcod and 7 (20%) were recaptured by sports fishermen fishing for salmon.

The sports and commercial fisheries appear to impact upon different sizes of lingcod. In the Campbell river area, male lingcod caught in the sports fishery were an average length of 59 cm compared to an average length of 69 cm in the commercial fishery, based on their length at tagging. Small sample sizes of females in the sports fishery at Campbell River (n=4) prevented a similar comparison of the size distribution of female lingcod.

In the Pender Harbour area the sports fishery also selects smaller size fish. The lengths of females recovered from the sports fishery in the Pender Harbour area (n=14) were, on average, smaller (60 cm) than the average length of all tagged females (76 cm). The mean length of tagged males caught in the sports fishery was similar to the mean length of all tagged males. However, because tagged males in the Pender Harbour area consisted of mainly smaller size lingcod, it would be difficult to detect differences in mean lengths of male tag releases and recoveries in that area. In the Stuart Island area where mainly smaller size lingcod were tagged, there was no difference in the mean lengths among tag releases and tag recoveries.

The difference between the proportion of tag recaptures in the sports (5%) and commercial (95%) fisheries at Campbell River can, in part, be explained by the fact that a disproportionately large number of tagged lingcod were larger (Fig. 3).

Tag loss

Of the 344 tag recoveries caught while tagging (November 1982-March 1983) at Campbell River, 26 were double-tagged. All double-tagged fish were caught with the primary tags intact and 5 (19%) were missing tags at the secondary tag site. A total of 35 double tag recoveries were reported during the 1983 fishing season (April 15-November 15). Twenty-seven(77.1%) were recovered with both tags intact. Tags were lost at both the primary and secondary tag sites; 7 (20.0%) at the primary tag site and 1 (2.9%) at the secondary tag site (Table 6). Of the total number of double-tagged lingcod caught during the 1982-83 tagging and fishing season (n=61), 7 (11.5%) lost tags at the primary tag site and 6 (9.8%) lost tags at the secondary site. Although based on a small sample size, the estimates of tag losses in this study were similar to that reported in other lingcod tagging studies (Cass et al. 1983a) where tag losses of 10% at the primary site occurred over a similar time period.

Tag movements

Of the 383 recoveries reported by specific location during the 1983 fishing season, 354 (92%) were recaptured within 5 km of their release sites of which 235 (61%) showed no detectable movement. Ten recoveries (3%) were recovered 20 km or more from their release sites (Table 7). These findings are consistent with results of other lingcod tagging studies (Hart 1943, Chatwin 1956, Reeves 1966, Cass et al. 1983a, b) and indicate that lingcod do not undertake extensive short-term movements.

Abundance estimates

Preliminary estimates of lingcod abundance in waters near Campbell River were calculated from tag release and recovery data collected while tagging using multiple census techniques of Schumacher and Eschmeyer (1943) and Schnabel (1938). Abundance estimates were determined for the combined areas of Big Rock, Willow Point, Shelter Point and Cape Mudge (Fig. 5). Abundance was not estimated for Discovery Passage, the Stuart Island or Pender Harbour areas because of small sample sizes of tag recaptures.

Since lingcod are not itinerant and since there was no evidence of recruitment during the tagging period (i.e. no apparent influx of smaller size fish), emigration and recruitment were assumed to be negligible. For present purposes we have also assumed that natural and tagging mortality during the tagging period was negligible. However, we recognized that mortality will result in an overestimate of the abundance (Ricker 1975). Abundance estimates were adjusted to account for a 11.5% rate of tag loss.

Tag release and recovery data were grouped into 5-d tagging intervals to conform to multiple census techniques. The formulae and computations used to determine abundance and variance estimates are presented in Appendix 3. A summary of the results is presented in Table 8.

Using the Schumacher and Echmeyer method, the abundance of lingcod at the time of tagging was 5400 males and 6800 females. Corresponding 95% confidence limits were 4200-7700 and 6100-7800 lingcod, respectively. The Schnabel estimate was 4900 (95% C.L. = 3600-7700) males and 6400 (95% C.L. = 5700-7300) females. For combined sexes the Schumacher and Eschmeyer estimate was 10,300 lingcod (95% C.L. = 9500-11,300) and the Schnabel estimate was 10,000 lingcod (95% C.L. = 8900-11,300).

Other species

Incidental catches of rockfish, dogfish and cabezon were taken at all three tagging areas. Catches of rockfish, primarily quillback and copper, accounted for 10.4% of the total catch; 6.5% near Campbell River, 47.0% near Stuart Island and 11.7% near Pender Harbour. Dogfish accounted for 4.6% of the total catch. At Stuart Island and Pender Harbour dogfish accounted for 14.5% and 11.7% of the total catch. Incidental catches of dogfish at Campbell River were comparatively low, accounting for 3.9% of the total catch. While cabezon were taken at all three tagging areas, they accounted for less than 1% of the total catch from all areas combined; 0.6% in the Campbell River area, 2.0% in the Stuart Island area and 1.3% in the Pender Harbour area.

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Table 1. Releases of tagged lingcod in the Strait of Georgia during 1982-83.[a]

Tagging period	Release area																				
	Shelter Point			Willow Point			Big Rock			Cape Mudge			S. Discovery Passage			Seymour Narrows			N. Discovery Passage		
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T
Nov 04-12	7	7	14	-	-	-	2	10	12	6	55	61	29	9	38	68	11	79	-	-	-
Nov 13-18	28	78	106	-	-	-	-	-	-	-	-	-	-	-	-	90	11	102	7	2	9
Nov 19-23	40	34	74	12	2	14	22	48	85	16	74	90	-	-	-	-	-	-	-	-	-
Nov 24-Dec 1	2	13	15	-	-	-	35	38	73	29	33	62	19	2	21	59	1	60	-	-	-
Dec 05-09	38	25	63	112	9	121	41	67	108	-	-	-	-	-	-	-	-	-	-	-	-
Dec 10-20	10	14	24	115	14	129	7	31	38	0	1	1	8	6	14	8	1	9			
Dec 22, 23-Jan 05-10	6	115	121	10	0	10	6	14	20	2	2	4	-	-	-	-	-	-	-	-	-
Jan 12-16	7	82	89	7	0	7	0	0	0	4	1	5	-	-	-	-	-	-	-	-	-
Jan 20-27	3	216	219	-	-	-	0	4	4	-	-	-	-	-	-	1	0	1	-	-	-
Jan 28-Feb 1	3	168	171	1	1	2	-	-	-	-	-	-	-	-	-	2	4	6	-	-	-
Feb 03-08	0	86	86	-	-	-	2	3	5	-	-	-	2	0	2	-	-	-	19	0	20
Feb 09-20	10	187	197	-	-	-	2	2	4	0	1	1	-	-	-	-	-	-	1	0	1
Feb 21-28	9	175	184	4	0	4	-	-	-	0	11	11	0	1	1	1	1	2	1	0	1
Mar 01-05	25	155	180	-	-	-	-	-	-	9	82	91	-	-	-	-	-	-	-	-	-
Mar 07-11	9	124	133	-	-	-	26	26	52	-	-	-	-	-	-	-	-	-	-	-	-
Total	197	1479	1676	261	26	287	143	243	401	66	260	326	58	18	76	229	29	259	28	2	30

Table 1 (cont'd)

Tagging period	Release area					
	Pender Harbour			Stuart Island		
	M	F	T	M	F	T
Nov 04-12	-	-	-	-	-	-
Nov 13-18	-	-	-	-	-	-
Nov 19-23	-	-	-	-	-	-
Nov 24-Dec 01	-	-	-	-	-	-
Dec 05-09	-	-	-	-	-	-
Dec 10-20	-	-	-	-	-	-
Dec 22, 23-Jan 05-10	28	35	63	-	-	-
Jan 12-19	34	24	59	8	14	23
Jan 20-27	116	45	161	29	25	54
Jan 28-Feb 01	33	53	86	-	-	-
Feb 03-08	27	18	45	-	-	-
Feb 09-20	65	27	92	92	128	220
Feb 21-28	99	29	128	4	6	10
Mar 01-05	-	-	-	-	-	-
Mar 07-11	-	-	-	-	-	-
Total	402	211	634	133	173	307

[a] Unsexed fish may be included in the total column.

Table 2. Age distribution and mean length at age of lingcod sampled in the Campbell River area, November 9-21, 1982.

	Male			Female			Total		
Age	No. of fish	Mean length cm	S.E.[a]	No. of fish	Mean length cm	S.E.	No. of fish	Mean length cm	S.E.
01	1	36.7	-	-	-	-	1	36.7	-
02	18	50.6	4.93	2	53.2	3.68	20	50.9	4.80
03	24	54.1	4.36	7	61.8	3.70	31	55.9	5.28
04	23	62.3	5.39	16	69.9	5.84	39	65.4	6.70
05	17	63.2	4.18	34	75.9	4.58	51	71.7	7.51
06	10	65.6	4.92	18	81.1	6.91	28	75.5	9.73
07	12	71.1	4.74	9	87.5	9.19	21	78.1	10.71
08	5	76.8	2.29	6	84.4	4.96	11	81.0	5.48
09	1	75.8	-	4	94.3	5.11	5	90.6	9.36
10	1	70.2	-	5	95.8	6.74	6	91.6	12.08
11	3	81.2	5.37	2	94.8	12.16	5	86.7	10.33
12	0	-	-	0	-	-	0	-	-
13	0	-	-	1	97.1	-	1	97.1	-
Total	115			104			219		

[a]SE = Standard Error.

Table 3. Recoveries of tagged lingcod while tagging in the Campbell River area during 1982-83.[a]

Recovery period	Recapture area																				
	Shelter Point			Willow Point			Big Rock			Cape Mudge			S. Discovery Passage			Seymour Narrows			N. Discovery Passage		
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T
Nov 04-12	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nov 13-18	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Nov 19-23	2	4	6	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nov 24-Dec 1	-	-	-	-	-	-	3	17	3	-	-	-	1	-	-	-	-	-	-	-	-
Dec 05-09	1	4	5	-	-	-	7	10	17	-	-	-	-	-	-	-	-	-	-	-	-
Dec 10-20	2	-	2	1	-	1	2	11	13	-	-	-	1	-	1	-	-	-	1	-	1
Dec 22,23-Jan 5-10	-	7	7	-	-	-	-	5	6	-	-	-	-	-	-	-	-	-	-	-	-
Jan 12-16	2	14	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Jan 20-27	-	20	20	-	-	-	-	2	2	-	-	-	-	-	-	-	-	-	-	-	-
Jan 28-Feb 1	-	23	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	2
Feb 03-08	-	18	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Feb 09-20	1	32	33	-	2	2	1	3	4	-	-	-	-	-	-	-	-	-	-	-	-
Feb 21-28	1	36	37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Mar 01-06	3	33	36	-	-	-	-	-	-	-	22	22	-	-	-	-	-	-	-	-	-
Mar 07-11	3	38	41	-	-	-	4	11	15	-	-	-	-	-	-	-	-	-	-	-	-
Total	15	230	245	2	1	3	18	51	73	0	22	22	2	0	2	0	0	0	2	1	3

[a]Unsexed fish may be included in the Totals column.

Table 4. Number of tag recaptures in the Campbell River area during the 1982-83 tagging period by the number of days spent at large.

Days at large	Tag recaptures	Days at large	Tag recaptures	Days at large	Tag recaptures
1	0	41	7	81	0
2	23	42	0	82	0
3	19	43	0	83	0
4	24	44	5	84	0
5	12	45	1	85	0
6	13	46	0	86	0
7	18	47	0	87	1
8	18	48	3	88	0
9	24	49	0	89	1
10	10	50	1	90	3
11	8	51	0	91	0
12	11	52	1	92	4
13	2	53	0	93	3
14	5	54	11	/	
15	8	55	0	103	1
16	4	56	0	104	1
17	5	57	4		
18	13	58	1		
19	10	59	0	TOTAL:	344
20	8	60	0		
21	7	61	1		
22	2	62	0		
23	5	63	2		
24	3	64	0		
25	7	65	0		
26	4	66	0		
27	3	67	2		
28	4	68	0		
29	4	69	1		
30	4	70	0		
31	4	71	0		
32	2	72	0		
33	0	73	1		
34	6	74	1		
35	2	75	0		
36	2	76	0		
37	1	77	0		
38	1	78	1		
39	4	79	1		
40	2	80	0		

Table 5. Lingcod tag recoveries reported during the 1983 fishing season by recovery method from releases during 1982-83.

	Release areas							
	Campbell River		Pender Harbour		Stuart Island		Total	
Target	N	%	N	%	N	%	N	%
Sport lingcod	15	4.6	26	74.3	7	23.3	48	12.20
Commercial lingcod	299	91.4	1	2.9	20	66.7	320	81.60
Sport - rockfish	0	-	0	-	0	-	0	-
Commercial - rockfish	1	0.3	0	-	2	6.7	3	0.77
Sport - salmon	2	0.6	7	20.0	1	3.3	10	2.55
Incidental to other comm. fisheries	5	1.5	0	-	0	-	5	1.28
Not reported (plant, etc.)	5	1.5	1	2.9	0	-	6	1.53
Total	327		35		30		392	100.00

Table 6. Summary of lingcod tag releases in the Strait of Georgia during 1982-83 and recoveries reported during the 1983 fishing season.

Release area	No. released	No. (%) of double-tagged releases	No. (%) of injected (OTC) releases	No. (%) sampled for age	No. (%) of recoveries	No. (%) double-tagged recoveries				No. (%) of recoveries sampled for age
						Total	Both	1°	2°	
Campbell River	3,054	312(10.2)	281(9.2)	222(9.5)	327(10.7)	29(9.3)	22(79.3)	16(22.7)	21(95.5)	21(9.5)
Pender Harbour	633	52(8.2)	-	-	35(5.5)	3(8.6)	2(66.7)	2(66.7)	-	-
Stuart Island	304	30(9.9)	-	-	30(9.9)	3(10.0)	3(100.0)	-	-	-

Table 7. Net movement of tagged lingcod released in the Strait of Georgia during 1982-83 and recovered in the 1983 fishing season.

Km	Shelter Pt. to Chatham Point	Pender Harbour	Stuart Island	Total
0	196	16	23	235
2	24	10	7	41
4	44	4	-	48
5	30	-	-	30
7	6	1	-	7
9	5	1	-	6
11	2	-	-	2
19	3	1	-	4
20	1	-	-	1
22	1	1	-	2
24	1	-	-	1
28	1	-	-	1
37	4	-	-	4
52	1	-	-	1
Total	319	34	30	383

Table 8. Abundance estimates of lingcod in waters near Campbell River, based on tag releases and recoveries during the 1982-83 tagging period.

	Method	
	Schumacher & Eschmeyer	Schnabel
	No. of fish (95% C.L.)	No. of fish (95% C.L.)
Males	5418 (4191-7660)	4938 (3637-7685)
Females	6829 (6058-7824)	6370 (5676-7259)
Total	10324 (9505-11299)	9979 (8944-11286)

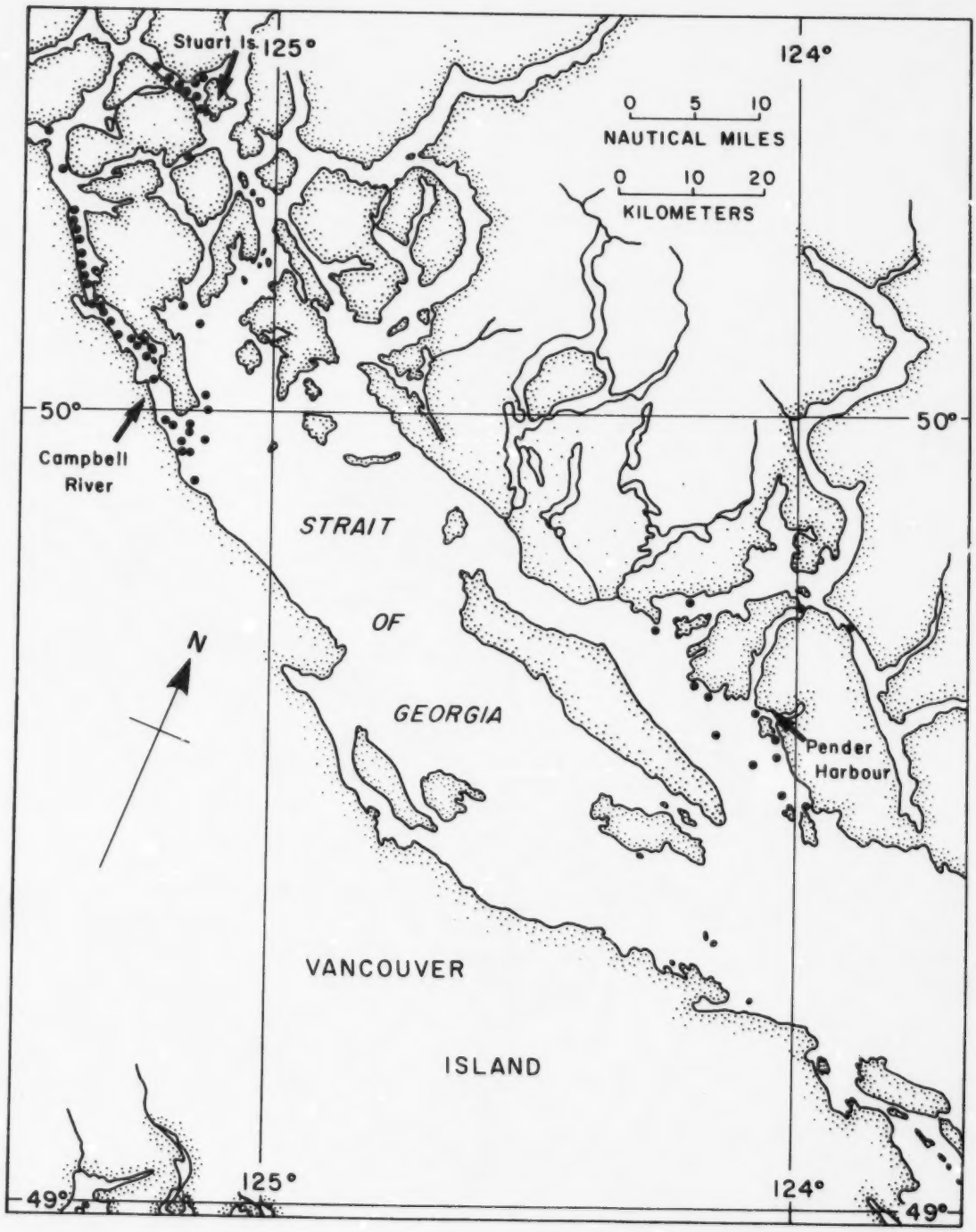
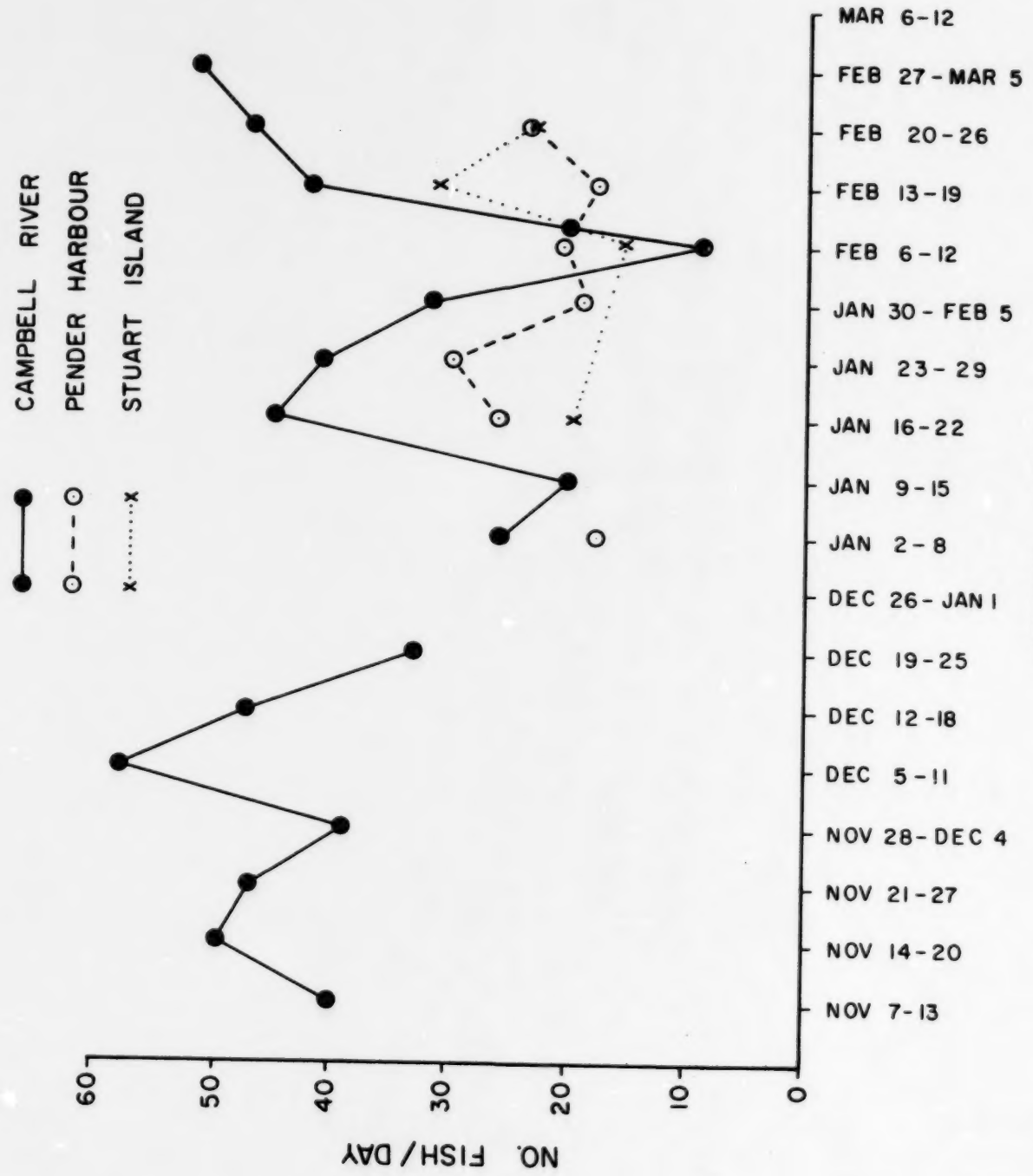


Fig. 1. Lingcod tag release sites in the Strait of Georgia, November 1982-March 1983.

Fig. 2. Catch rates of lingcod during tagging studies in the Strait of Georgia, November 1982-March 1983.


CAMPBELL RIVER
PENDER HARBOUR
STUART ISLAND
NO. FISH / DAY
0
10
20
30
40
50
60
TAGGING WEEK
MAR 6-12
FEB 27 - MAR 5
FEB 20-26
FEB 13-19
FEB 6-12
JAN 30 - FEB 5
JAN 23-29
JAN 16-22
JAN 9-15
JAN 2-8
DEC 26 - JAN 1
DEC 19-25
DEC 12-18
DEC 5-11
NOV 28 - DEC 4
NOV 21-27
NOV 14-20
NOV 7-13

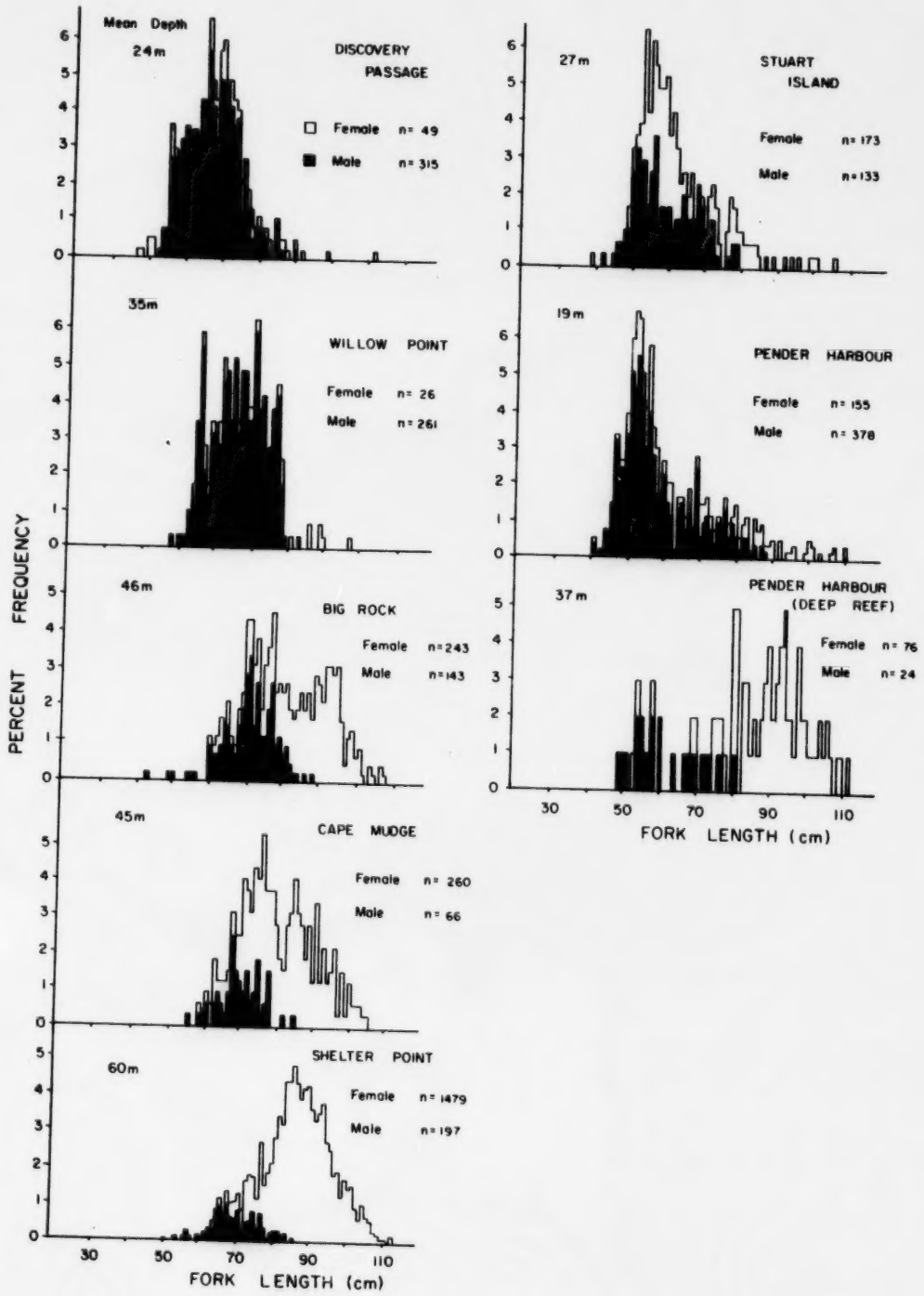


Fig. 3. Length-frequency histograms of lingcod caught during tagging studies in the Strait of Georgia, November 1982-March 1983.

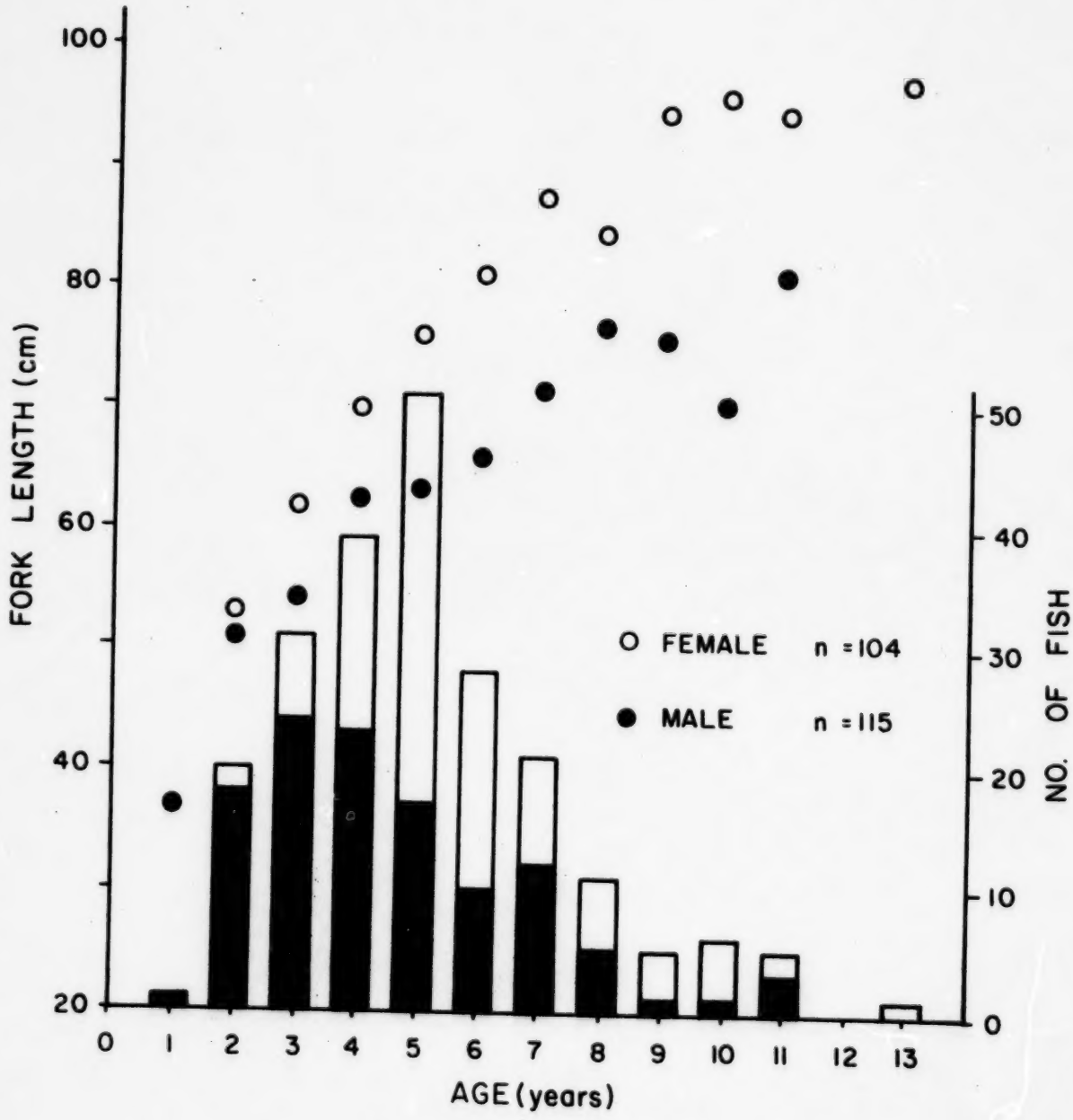


Fig. 4. Age distribution and growth of lingcod sampled during tagging studies in the Campbell River area of the Strait of Georgia, November, 1982.

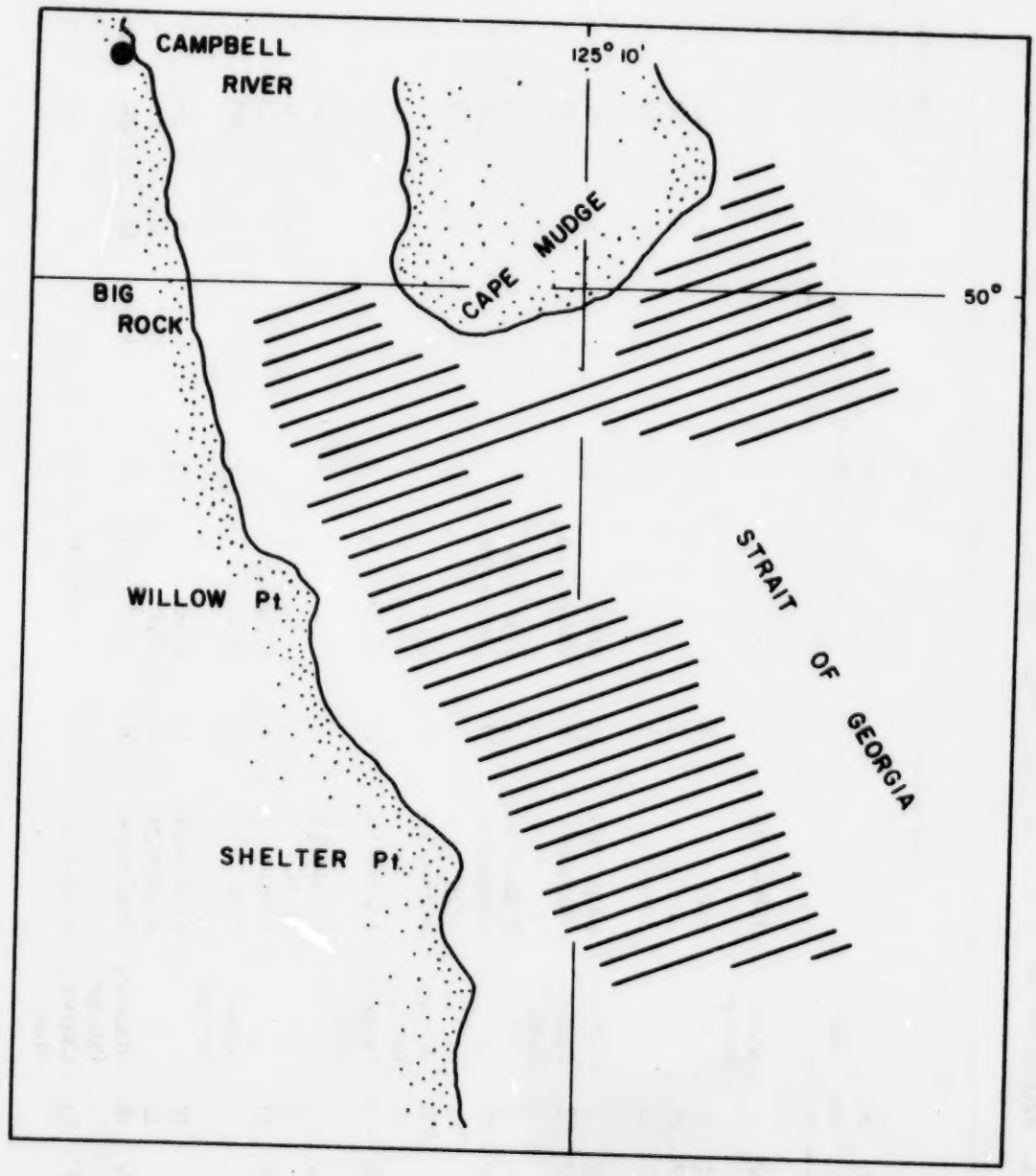


Fig. 5. Lingcod tag release and recovery area (hatched) for which population estimates were determined during tagging studies in the Campbell River area of the Strait of Georgia, November 1982-March 1983.

Appendix 1, table 1. Numbers and identification of tagged lingcod released in the Campbell River area during 1982-83.

Release vessel	Release date	Set no.	Location	Primary tags		Secondary tags		No. injected	No. tins collected	Cumulative totals		
				I.D. no. B82	No. released	I.D. no. B82	No. released			1° tags	2° tags	1°+2° tags
ARRAN TIDE	Nov 12/82	17	Seymour Narrows	31442-31461	10	31445	1	1	-	10	-	1
	Nov 09/82	18	"	31451	1	-	-	-	-	11	-	1
	Nov.10/82	21	"	31452-31458	7	-	-	-	-	18	-	1
	Nov.11/82	23	"	31460	1	-	-	-	-	19	-	1
MISS QUADRA	Nov.04/82	1	"	67010-67024	14	67012	1	6	-	33	-	2
	Nov 09/82	2	Cape Mudge	6700-67043	26	67001-67036	3	3	13	59	-	5
		3	"	67044-67057	12	67045-67056	2	2	6	71	-	7
	Nov 10/82	4	"	67058-67099	37	67069-67098	3	3	15	108	-	10
		5	"	67097	1	-	-	-	-	109	-	10
		6	Willow Point	67096-67114	15	67111	1	1	7	124	-	11
	Nov 11/82	7	Campbell River	67115-67134	19	67126-67135	2	2	9	143	-	13
	Nov 11/82	8	"	67136-67138	3	-	-	-	1	146	-	13
		9	"	67139	1	-	-	-	1	147	-	13
	Nov 12/82	10	"	67140-67156	16	67150	1	1	8	163	-	14
		11	Seymour Narrows	67157-67173	15	67161-67172	2	2	8	178	-	16
		12	"	67174-67186	12	67183	1	1	6	190	-	17
		13	"	67187-67206	19	67197	1	2	10	209	-	18
	Nov 13/82	14	Discovery Passage	67207-67240	31	67208-67241	4	3	16	240	-	22
	Nov 14/82	15	Campbell River	67242-67297	51	67252-67296	5	5	26	291	-	27

Appendix 1, table 1 (cont'd)

Release vessel	Release date	Set no.	Location	Primary tags		Secondary tags		No. injected	No. fins collected	Cumulative totals		
				I.D. no. B82	No. released	I.D. no. B82	No. released			1° tags	2° tags	1°+2° tags
MISS QUADRA	Nov 14/82	16	Campbell River	67298-67301	4	-	-	-	2	296	-	27
	Nov 15/82	17	Discovery Passage	67302-67319	17	67312	1	1	6	312	-	28
		18	"	67320-67329	9	67323	1	1	3	321	-	29
	Nov 17/82	19	Willow Point	67330-67386	52	67332-67387	6	6	26	373	-	35
	Nov 18/82	20	Willow Point	67388-67449	57	67398-67443	5	5	27	430	-	40
	Nov 19/82	21	Cape Mudge	67450-67526	70	67461-67518	6	6	14	500	-	46
	Nov 20/82	22	Willow Point	67527-67562	33	67341-67563	4	4	5	533	-	50
		23	"	67564-67571	8	-	-	-	2	541	-	50
		24	Cape Mudge	67572-67575	4	-	-	-	1	545	-	50
	Nov.21/82	25	"	6756-67580	5	-	-	-	2	550	-	50
		26	"	67581-67583	3	-	-	-	1	553	-	50
		27	"	67584-67599	14	67586-67598	2	2	3	567	-	52
		28	Willow Point	67600-67611	11	67608	1	1	3	578	-	53
		29	"	67612-67617	5	67614	1	1	1	583	-	54
	Nov 22/82	30	Cape Mudge	67618-67648	29	67628-67639	2	2	-	612	-	56
		31	Willow Point	67649-67650	2	67651	1	-	-	614	-	57
		32	"	67652-67669	17	67664	1	2	-	631	-	58
		33	Cape Mudge	67670-67673	4	-	-	-	-	635	-	58
	Nov 23/82	34	"	67674-67727	50	67684-67717	4	4	-	685	-	62
		35	Willow Pt.	67728-67743	15	67738	1	1	-	700	-	63

Appendix 1, table 1 (cont'd)

Release vessel	Release date	Set no.	Location	Primary tags		Secondary tags		No. injected	No. fins collected	Cumulative totals		
				I.D. no. B82	No. released	I.D. no. B82	No. released			1° tags	2° tags	1°&2° tags
MISS QUADRA	Nov 24/82	36	Cape Mudge	67744-67812	63	67754-67809	6	6	-	763	-	69
	Nov 25/82	37	Campbell River	67813-67821	9	-	-	-	-	772	-	69
		38	Seymour Narrows	67822-67848	24	67825-67846	3	3	-	795	-	72
		39	Campbell River	67849-67862	4	-	-	-	-	800	-	72
		40	Seymour Narrows	67853-67868	15	67863	1	1	-	815	-	73
	Nov 29/82	41	Discovery Passage	67869-67889	20	67879-67890	2	2	-	835	-	75
		42	Seymour Narrows	67891-67892	2	-	-	-	-	837	-	75
	Nov 30/82	43	Cape Mudge	67893-67922	28	67903-67914	2	2	-	865	-	77
		44	Campbell River	67923-67931	9	-	-	-	-	874	-	77
	Dec 01/82	45	Cape Mudge	67932-67980	45	67942-67975	4	4	-	919	-	81
		46	Willow Pt.	67981-67996	15	67992	1	1	-	935	-	82
	Dec 05/82	47	"	67997-79020	22	79007-79018	2	2	-	956	-	84
	Dec 05/82	48	Cape Mudge	79021-79042	21	79041-79043	2	2	-	977	-	86
	Dec 06/82	49	Willow Pt.	79044-79088	41	79054-79087	4	4	-	1018	-	90
	Dec 07/82	50	Cape Mudge	79089-79133	41	79099-79132	4	4	-	1059	-	94
		51	Willow Pt.	79134-79165	30	79144-79166	3	3	-	1089	-	97
	Dec 08/82	52	Cape Mudge	79167-79223	51	79168-79222	6	5	-	1140	-	103
		53	Willow Pt.	79224-79249	23	79226-79246	3	2	-	1163	-	106
	Dec 09/82	54	"	79250-79254	5	-	-	-	-	1168	-	106
		55	"	79256-79326	65	79256-79327	8	6	-	1233	-	114

Appendix 1, table 1 (cont'd)

Release vessel	Release date	Set no.	Location	Primary tags		Secondary tags		No. injected	No. fins collected	Cumulative totals		
				I.D. no. B82	No. released	I.D. no. B82	No. released			1° tags	2° tags	1°+2° tags
MISS QUADRA	Dec 10/82	56	Willow Pt.	79328-79390	656	79330-79385	6	5	-	1289	1	120
	Dec 13/82	57	Cape Mudge	79391-79398	7	79393	1	1	-	1296	1	121
		58	Willow Pt.	79399-79459	55	79402-79456	6	6	-	1361	1	127
	Dec 16/82	59	Cape Mudge	79460-79496	33	79462-79495	4	4	-	1384	1	131
	Dec 19/82	60	"	79497	1	-	-	1	-	1385	1	131
		61	Willow Pt.	79498-79524	24	79499-79521	3	2	-	1409	1	134
		62		79525-79544	18	79527-79540	2	2	-	1427	1	136
	Dec 20/82	63	Seymour Narrows	79545-79554	9	79547	1	1	-	1436	1	137
		64	"	79555-79563	8	79557	1	1	-	1444	1	138
		65	Campbell River	79564-79569	5	79565	1	1	-	1449	1	139
		66	"	79570	1	79571	1	-	-	1450	1	140
	Dec 22/82	67	Cape Mudge	79572-79585	13	79575-79586	2	3	-	1463	1	142
		68	Willow Pt.	79587-79597	10	79588-79598	2	1	-	1473	1	144
	Dec 23/82	69	"	79599-79648	45	79601-79645	5	5	-	1518	1	149
	Jan 05/83	70	"	79649-79672	22	79659-79670	2	2	-	1540	1	151
	Jan 08/83	71	Cape Mudge	79673-79676	4	-	-	-	-	1544	1	151
		72	Willow Pt.	79677-79705	27	79687-79698	2	2	-	1571	1	153
	Jan 10/83	73	Cape Mudge	79706-79713	8	-	-	-	-	1579	1	153
		74	Willow Pt.	79714-79743	28	79724-79736	2	3	-	1607	1	155
	Jan 12/83	75	"	79744-79749	6	-	-	-	-	1613	1	156
	Jan 13/83	76	"	79750-79803	50	79760-79793	4	4	-	1663	1	159
		77	"	79804	1	-	-	-	-	1664	1	159
	Jan 14/83	78	Sutil Channel	79805-79808	4	-	-	-	-	1668	1	159
	Jan 15/83	79	"	79809	1	-	-	-	-	1669	1	159

Appendix 1, table 1 (cont'd)

Release vessel	Release date	Set no.	Location	Primary tags		Secondary tags		No. injected	No. fins collected	Cumulative totals		
				I.D. no. B82	No. released	I.D. no. B82	No. released			1° tags	2° tags	1°+2° tags
MISS QUADRA	Jan 16/83	80	Willow Pt.	79810-79850	38	79820-79842	3	3	-	1707	1	162
		81	"	79851	1	-	-	-	-	1708	1	162
	Jan 20/83	82	"	79852-79905	50	79862-79906	5	4	-	1758	1	167
		83	Cape Mudge	79907-79910	3	79908	1	-	-	1761	1	168
	Jan 21/83	84	Willow Pt.	79911-79962	47	79912-79955	5	5	-	1808	1	173
	Jan 22/83	85	"	79963-80014	46	79964-80009	6	4	-	1864	1	179
	Jan 23/83	86	Seymour Narrows	80015	1	80016	1	-	-	1865	1	180
	Jan 27/83	87	Cape Mudge	80017-80019	2	80018	1	1	-	1857	1	181
		88	Willow Point	80020-80108	80	80022-80099	9	8	-	1937	1	190
	Jan 28/83	89	"	80108-80133	22	80110-80132	3	3	-	1959	1	193
		90	"	80134-80136	2	80135	1	1	-	1961	1	194
	Jan 29/83	91	"	80137-80200	58	80138-80193	6	6	-	2019	1	200
	Jan 30/83	92	Discovery Passage	80201-80202	2	80203	1	-	-	2021	1	201
		93	"	80204-80208	5	-	-	1	-	2027	1	201
	Jan 31/83	94	Willow Pt.	80209-80212	3	80210	1	1	-	2029	1	202
		95	"	80213-80261	45	80223-80256	4	4	-	2074	1	206
	Feb 01/83	96	"	80262-80310	45	80263-80296	4	4	-	2119	1	210
	Feb 03/83	97	Campbell River	80311-80313	3	-	-	-	-	21122	1	210
	Feb 04/83	98	Cape Mudge	80314-80317	4	-	-	-	-	2127	1	210
		99	Willow Pt.	80318-80367	46	80328-80361	4	4	-	2172	1	214
		100	Cape Mudge	80368-80369	2	-	-	-	-	2174	1	214
	Feb 05/83	101	Willow Pt.	80370-80413	41	80380-80414	4	3	-	2215	1	218
	Feb 07/83	102	Discovery Passage	80415	1	-	-	-	-	2216	1	218

Appendix 1, table 1 (cont'd)

Release vessel	Release date	Set no.	Location	Primary tags		Secondary tags		No. injected	No. fins collected	Cumulative totals		
				I.D. no. B82	No. released	I.D. no. B82	No. released			1° tags	2° tags	1°+2° tags
MISS QUADRA	Feb 07/83	103	Discovery Passage	80416-80417	2	-	-	-	-	2218	1	218
		104	"	80418-80419	2	-	-	-	-	2220	1	218
		105	"	80420-80421	2	-	-	-	-	2222	1	218
		106	"	80427-80428	2	-	-	-	-	2227	1	218
	Feb 08/83	107	"	80427-80428	2	-	-	-	-	2229	1	218
	Feb 08/83	108	Discovery Passage	80429-80435	6	80433	1	-	-	2235	1	219
	Feb 09/83	109	"	80436	1	-	-	-	-	2236	1	219
		110	"	80437	1	-	-	-	-	2237	1	219
	Feb 13/83	111	Willow Pt.	80438-80462	23	80449-80459	2	-	-	2260	1	221
		112	Cape Mudge	80463-80464	2	-	-	-	-	2262	1	221
	Feb 15/83	113	Willow Pt.	80465-80499	31	80475-80497	3	2	-	2293	2	224
	Feb 18/83	114	Cape Mudge	80500	1	-	-	-	-	2294	2	224
		115	Willow Pt.	80501-80577	71	80512-80570	6	6	-	2366	2	230
	Feb 20/83	116	Willow Pt.	80578-80659	74	80579-80656	8	11	-	2439	2	238
		117	Cape Mudge	80660-80661	2	-	-	-	-	2441	2	238
	Feb 21/83	118	Willow Pt.	80662-80772	101	80663-80762	10	10	-	2542	2	248
	Feb 22/83	119	Seymour Narrows	80773-80774	2	80774	1	-	-	2544	2	249
		120	Campbell River	80776	1	-	-	-	-	2545	2	249
	Feb 24/83	121	Cape Mudge	80777-80781	4	80778	1	1	-	2549	2	250
		122	Willow Pt.	80782-80786	5	-	-	-	-	2554	2	250
	Feb 27/83	123	Willow Pt.	80787-80858	20	80788-80799	2	3	-	2574	2	252
		124	Cape Mudge	80859-80866	7	80860	1	-	-	2581	2	253
	Feb 28/83	125	Willow Pt.	80867-80937	64	80868-80934	7	10	-	2645	2	260

Appendix 1, table 1 (cont'd)

Release vessel	Release date	Set no.	Location	Primary tags		Secondary tags		No. injected	No. fins collected	Cumulative totals		
				I.D. no. B82	No. released	I.D. no. B82	No. released			1° tags	2° tags	1°+2° tags
MISS QUADRA	Mar 01/83	126	Willow Pt.	80938-80994 31482	57	80938-80994	6	7	-	2702	2	266
	Mar 02/83	127	"	31483-31492	9	31484	1	2	-	2711	2	267
		128	Cape Mudge	31493-31532	34	31494-31529	6	4	-	2746	2	273
	Mar 03/83	129	"	31533-31537	4	31534	1	-	-	2749	2	274
		130	"	31538-31541	4	-	-	-	-	2753	2	274
		131	"	31542-31593	49	31551-31584	3	4	-	2802	2	277
	Mar 04/83	132	Willow Pt.	31594-31653	54	31595-31651	6	5	-	2856	2	283
	Mar 05/83	133	"	31654-31721	62	31655-31722	7	7	-	2918	2	290
	Mar 07/83	134	Cape Mudge	31723-31772	45	31728-31768	5	-	-	2963	2	295
	Mar 09/83	135	"	31773-31782	9	31774	1	-	-	2972	2	296
	Mar 10/83	136	Willow Pt.	31783-31898	95	31784-31883	10	-	-	3067	2	306
	Mar 11/83	137	"	31887-31948	54	31889-31947	6	-	-	3121	2	312

Appendix 1, table 2. Numbers and identification of tagged lingcod released in the Stuart Island area during 1983.

Release date 1983	Set no.	Location	Primary tags		Secondary tags		No. injected	Cumulative totals		
			I.D. no. B82	No. released	I.D. no. B82	No. released		1° tags	2° tags	1°+2° tags
Jan 18	1	Stuart Is.	81000-81009	1	81001	1	-	9	-	1
Jan 19	4		81010-81027	16	81012-81022	2	-	25	-	3
Jan 20	12		81028-81057	27	81032-81052	3	-	52	-	6
	15		81058-81050	3	-	-	-	55	-	6
Jan 21	20		81061-81084	22	81064-81076	2	-	77	-	8
	25		81085-81090	5	81086	1	-	82	-	9
Feb 10	27		81091-81100	10	-	-	-	92	-	9
Feb 11	30		81101-81104	3	81102	1	-	95	-	10
	33		81105-81117	12	81113	1	-	107	-	11
	34		81118-81122	5	-	-	-	112	-	11
Feb 12	35		81123	1	-	-	-	113	-	11
	36		81124-81130	6	81126	1	-	111	-	12
	38		81131-81143	12	81140	1	-	131	-	13
	39		81144-81151	8	-	-	-	139	-	13
Feb 13	40		81152-81167	14	81154-81164	2	-	153	-	15
	42		81168-81178	10	81175	1	-	163	-	16
	44		81179-81188	9	81185	1	-	172	-	17
	46		81189	1	-	-	-	173	-	17
	47		81190-81197	7	81196	1	-	180	-	18
Feb 14	48		81198-81209	11	81204	1	-	191	-	19
	49		81210-81212	3	-	-	-	194	-	19
	50		81213-81219	6	81216	1	-	200	-	20
Feb 17	52		81220-81241	21	81234	1	-	221	-	21
Feb 18	53		81242-81244	3	-	-	-	224	-	21
	54		81245-81256	12	-	-	-	236	-	21
	56		81257-81271	7	81259	1	-	243	-	22

Appendix 1, table 2 (cont'd)

Release date 1983	Set no.	Location	Primary tags		Secondary tags			Cumulative totals		
			I.D. no. B82	No. released	I.D. no. B82	No. released	No. injected	1° tags	2° tags	1°+2° tags
Feb 18	57	Stuart Is.	81264-81267	4	-	-	-	247	-	22
	58		81268-81274	6	-	-	-	253	-	22
	59		81275-81283	8	81281	1	-	261	-	23
Feb 19	60		81284-81295	11	81293	1	-	272	-	24
	61		81296-81328	31	81314-81326	2	-	303	-	26
	62		81329-81332	4	-	-	-	307	-	26
Feb 20	63		81333-81337	5	-	-	-	312	-	26
	64		81338-81360	5	-	-	-	317	-	26
	65		81342-81374	17	81346-81357	2	-	334	-	28
	66		81361-81376	14	81365	1	-	348	-	29
Feb 21	67		81374-81379	3	-	-	-	351	-	29
	69		81380-81382	3	-	-	-	354	-	29
	70		81383-81387	4	81384	1	-	358	-	30

Appendix 1, table 3. Numbers and identification of tagged lingcod released in the Pender Harbour area during 1983.

Release date 1983	Set no.	Location	Primary tags		Secondary tags		No. injected	Cumulative totals		
			I.D. no. B82	No. released	I.D. no. B82	No. released		1° tags	2° tags	1°+2° tags
Jan 4	1	Pender Harbour	77000-77010	10	77001	1	-	10	-	1
Jan 5	2		77011-77023	12	77021	1	-	22	-	2
	3		77024-77026	3	-	-	-	25	-	2
Jan 6	4		77027-77059	31	77041-77051	2	-	56	-	4
	5		77060-77061	2	-	-	-	58	-	4
	6		77062-77065	3	77063	1	-	61	-	5
Jan 8	7		77066-77075	10	-	-	-	71	-	5
Jan 17	8		77076-77087	11	77086	1	-	82	-	6
Jan 18	9		77088-77091	4	-	-	-	86	-	6
	10		77092-77099	8	77101	1	-	94	-	7
Jan 19	11		77100-77146	43	77114-77138	3	-	137	-	10
Jan 20	12		77147-77183	34	77157-77179	3	-	171	-	13
Jan 21	13		77184-77193	10	77194	1	-	181	-	14
	14		77195-77249	29	77205-77216	2	-	210	-	16
Jan 26	15		77225-77267	38	77235-77262	3	-	248	1	19
Jan 27	16		77268-77334	62	77281-77331	5	-	310	1	24
Jan 28	17		77335-77362	26	77349-77356	2	-	336	1	26
Jan 30	18		77363-77371	9	-	-	-	345	1	26
Jan 31	19		77372	1	-	-	-	346	1	26
	20		77373-77403	29	77383-77394	2	-	375	1	28
Feb. 1	21		77404-77428	23	77414-77425	2	-	398	1	30
Feb. 7	22		77429-77431	3	-	-	-	401	1	30
	23		77432-77474	23	77442-77452	2	-	424	1	32
Feb 8	24		77456-77465	10	77466	1	-	434	1	33
	25		77467-77477	10	77478	1	-	444	1	34

Appendix 1, table 3 (cont'd)

Release date 1983	Set no.	Location	Primary tags		Secondary tags		No. injected	Cumulative totals		
			I.D. no. B82	No. released	I.D. no. B82	No. released		1° tags	2° tags	1°+2° tags
Feb 15	26	Pender Harbour	77479-77524	42	77489-77522	4	-	486	1	38
Feb 16	27		77525-77529	5	-	-	-	491	1	38
	28		77530-77545	15	77537	1	-	506	1	39
Feb 18	29		77546-77580	33	77557-77568	2	-	539	1	41
Feb 21	30		77581-77621	38	77594-77616	3	-	577	1	44
Feb 22	31		77622-77659	35	77633-77655	3	-	612	1	47
Feb 23	32		77660-77709	46	77670-77703	4	-	658	1	51
Feb 24	33		77710-77724	14	77720	1	-	672	1	52

Appendix 2 table 1. Length frequency of tagged lingcod released in the Campbell River area during 1982-1983.

Area Fork length (cm)	SHELTER PT.			WILLOW PT.			BIG ROCK			CAPE MUDGE		
	M	F	T	M	F	T	M	F	T	M	F	T
37	-	-	-	-	-	-	-	-	-	-	-	-
38	-	-	-	-	-	-	-	-	-	-	-	-
39	-	-	-	-	-	-	-	-	-	-	-	-
40	-	-	-	-	-	-	-	-	-	-	-	-
41	-	-	-	-	-	-	-	-	-	-	-	-
42	-	-	-	-	-	-	-	-	-	-	-	-
43	-	-	-	-	-	-	-	-	-	-	-	-
44	-	-	-	-	-	-	-	-	-	-	-	-
45	-	-	-	-	-	-	-	-	-	1	-	1
46	-	-	-	-	-	-	-	-	-	0	-	0
47	-	-	-	-	-	-	-	-	-	0	-	0
48	-	-	-	1	-	1	-	-	-	0	-	0
49	-	-	-	0	-	0	1	-	1	0	-	0
50	-	-	-	1	-	1	1	-	1	0	-	0
51	-	1	1	1	-	1	0	-	0	0	-	0
52	-	0	0	0	1	1	0	-	0	0	-	0
53	-	0	0	3	0	3	0	-	0	0	-	0
54	1	1	2	4	1	5	1	-	1	0	-	0
55	0	0	0	10	0	10	0	-	0	1	-	1
56	2	1	3	16	1	17	1	-	1	1	-	1
57	4	1	5	6	2	8	0	-	0	0	-	0
58	1	1	2	4	1	5	0	-	0	0	-	0
59	0	0	0	9	1	10	0	-	0	1	1	2
60	2	1	3	8	0	8	4	1	5	1	0	1
61	1	1	2	8	2	10	3	1	4	2	1	3
62	4	0	4	13	2	15	3	2	5	0	2	2
63	4	2	6	14	0	14	4	3	7	2	4	6
64	6	3	9	10	0	10	6	0	6	3	1	4
65	11	3	14	15	0	15	6	2	9	2	2	4
66	16	4	20	9	1	10	4	1	5	1	3	4
67	10	2	12	14	0	14	3	0	4	3	2	5
68	17	6	23	14	0	14	6	1	8	8	2	10
69	11	7	18	10	1	11	8	2	10	5	3	8
70	10	8	18	11	0	11	12	5	18	4	4	8
71	14	8	22	17	1	18	13	3	17	4	10	14
72	2	13	15	8	0	8	6	7	13	5	7	12
73	8	20	28	12	0	12	11	5	16	2	8	10
74	9	22	31	6	0	6	5	3	8	3	11	14
75	14	16	30	7	1	8	5	6	13	6	7	13
76	6	14	20	11	0	11	8	5	15	1	16	17
77	13	33	46	12	1	13	11	7	19	2	10	12
78	6	20	26	5	2	7	4	6	10	5	7	12
79	2	30	32	1	0	1	5	5	11	0	12	12

Appendix 2 table 1 (cont'd)

Area	SHELTER PT.			WILLOW PT.			BIG ROCK			CAPE MUDGE		
Fork length (cm)	M	F	T	M	F	T	M	F	T	M	F	T
80	4	32	36	0	0	0	3	6	10	0	9	9
81	5	43	48	1	0	1	4	7	11	0	6	6
82	5	53	58	-	0	0	1	5	7	2	4	6
83	3	51	54	-	1	1	1	6	7	0	9	9
84	4	70	74	-	0	0	1	5	8	0	10	10
85	0	74	74	-	0	0	0	10	10	1	12	13
86	2	79	81	-	2	2	1	7	8	-	10	10
87	-	73	73	-	1	1	0	10	10	-	9	9
88	-	66	66	-	0	0	1	6	7	-	6	6
89	-	70	70	-	2	2	-	12	12	-	9	9
90	-	72	72	-	1	1	-	11	11	-	4	4
91	-	61	61	-	0	0	-	9	9	-	11	11
92	-	56	56	-	0	0	-	13	13	-	4	4
93	-	60	60	-	0	0	-	12	12	-	8	8
94	-	64	64	-	0	0	-	12	12	-	4	4
95	-	46	46	-	0	0	-	13	13	-	5	5
96	-	43	43	-	0	0	-	7	7	-	7	7
97	-	31	31	-	1	1	-	2	2	-	1	1
98	-	33	33	-	-	-	-	5	5	-	5	5
99	-	21	21	-	-	-	-	6	6	-	1	1
100	-	29	29	-	-	-	-	3	3	-	4	4
101	-	25	25	-	-	-	-	4	4	-	2	2
102	-	26	26	-	-	-	-	1	1	-	2	2
103	-	16	16	-	-	-	-	0	0	-	2	2
104	-	11	11	-	-	-	-	2	2	-	1	1
105	-	17	17	-	-	-	-	1	1	-	2	2
106	-	12	12	-	-	-	-	0	0	-	-	-
107	-	10	10	-	-	-	-	2	2	-	-	-
108	-	5	5	-	-	-	-	1	1	-	-	-
109	-	4	4	-	-	-	-	-	-	-	-	-
110	-	2	2	-	-	-	-	-	-	-	-	-
111	-	2	2	-	-	-	-	-	-	-	-	-
112	-	1	1	-	-	-	-	-	-	-	-	-
113	-	3	3	-	-	-	-	-	-	-	-	-
TOTAL	197	1479	1676	261	26	287	143	243	401	66	260	326

Appendix 2 table 1 (cont'd)

Area Fork length (cm)	SOUTH DISCOVERY PASSAGE			SEYMOUR NARROWS			NORTH DISCOVERY PASSAGE			TOTAL		
	M	F	T	M	F	T	M	F	T	M	F	T
37	-	-	-	-	-	-	1	-	1	1	-	1
38	-	-	-	-	-	-	1	-	1	1	-	1
39	-	-	-	-	-	-	0	-	0	0	-	0
40	1	-	1	1	-	1	0	-	0	2	-	2
41	0	-	0	1	-	1	1	-	1	2	-	2
42	0	-	0	0	-	0	0	-	0	0	-	0
43	0	-	0	1	-	1	0	-	0	1	-	1
44	0	-	0	1	-	1	2	-	2	4	-	4
45	3	-	3	0	-	0	0	-	0	3	-	3
46	4	-	4	8	-	8	1	1	2	13	1	14
47	5	-	5	4	1	5	1	0	1	10	1	11
48	2	-	2	3	0	3	1	0	1	7	0	7
49	1	-	1	8	0	8	3	0	3	13	0	13
50	6	-	6	7	0	7	0	1	1	15	1	16
51	1	-	1	7	2	9	2	-	2	11	3	14
52	6	1	7	4	1	5	1	-	1	11	3	14
53	1	0	1	8	1	9	1	-	1	13	1	14
54	4	0	4	10	0	10	2	-	2	22	2	24
55	5	0	5	10	0	10	0	-	0	26	0	26
56	2	2	4	18	2	20	1	-	1	41	6	47
57	0	0	0	15	3	18	0	-	0	25	6	31
58	3	0	3	9	3	13	0	-	0	17	5	23
59	4	1	5	13	2	15	1	-	1	28	5	33
60	2	1	3	14	3	17	2	-	2	33	6	39
61	1	3	4	12	0	12	1	-	1	28	8	36
62	0	1	1	14	2	16	1	-	1	35	9	44
63	0	2	2	12	1	13	1	-	1	37	12	49
64	3	1	4	11	0	11	0	-	0	39	5	44
65	0	1	1	6	1	7	1	-	1	41	9	51
66	0	0	0	10	0	10	0	-	0	40	9	49
67	1	1	2	4	1	5	0	-	0	35	6	42
68	1	0	1	4	0	4	0	-	0	50	9	60
69	0	0	0	1	1	2	1	-	1	36	14	50
70	1	1	2	2	0	2	0	-	0	40	18	59
71	0	0	0	3	0	3	0	-	0	51	22	74
72	0	0	0	2	1	3	0	-	0	23	28	51
73	0	0	0	2	0	2	0	-	0	35	33	68
74	0	0	0	0	0	0	0	-	0	23	36	59
75	1	0	1	2	0	2	1	-	1	36	30	68
76	-	0	0	1	1	2	0	-	0	27	36	65
77	-	0	0	0	1	1	1	-	1	39	52	92
78	-	1	1	0	0	0	-	-	-	20	36	56
79	-	0	0	0	0	0	-	-	-	8	47	56

Appendix 2 table 1 (cont'd)

Area Fork length (cm)	SOUTH DISCOVERY PASSAGE			SEYMOUR NARROWS			NORTH DISCOVERY PASSAGE			TOTAL		
	M	F	T	M	F	T	M	F	T	M	F	T
80	-	1	1	1	0	1	-	-	-	8	48	57
81	-	0	0	-	0	0	-	-	-	10	56	66
82	-	1	1	-	0	0	-	-	-	8	63	72
83	-	-	-	-	0	0	-	-	-	4	67	71
84	-	-	-	-	0	0	-	-	-	5	85	92
85	-	-	-	-	0	0	-	-	-	1	96	97
86	-	-	-	-	0	0	-	-	-	3	98	101
87	-	-	-	-	0	0	-	-	-	0	93	93
88	-	-	-	-	0	0	-	-	-	1	78	79
89	-	-	-	-	1	1	-	-	-	-	94	94
90	-	-	-	-	0	0	-	-	-	-	88	88
91	-	-	-	-	0	0	-	-	-	-	81	81
92	-	-	-	-	0	0	-	-	-	-	73	73
93	-	-	-	-	0	0	-	-	-	-	80	80
94	-	-	-	-	0	0	-	-	-	-	80	80
95	-	-	-	-	0	0	-	-	-	-	64	64
96	-	-	-	-	0	0	-	-	-	-	57	57
97	-	-	-	-	0	0	-	-	-	-	35	35
98	-	-	-	-	0	0	-	-	-	-	43	43
99	-	-	-	-	0	0	-	-	-	-	28	28
100	-	-	-	-	0	0	-	-	-	-	36	36
101	-	-	-	-	0	0	-	-	-	-	31	31
102	-	-	-	-	1	1	-	-	-	-	30	30
103	-	-	-	-	-	-	-	-	-	-	18	18
104	-	-	-	-	-	-	-	-	-	-	14	14
105	-	-	-	-	-	-	-	-	-	-	20	20
106	-	-	-	-	-	-	-	-	-	-	12	12
107	-	-	-	-	-	-	-	-	-	-	12	12
108	-	-	-	-	-	-	-	-	-	-	6	6
109	-	-	-	-	-	-	-	-	-	-	4	4
110	-	-	-	-	-	-	-	-	-	-	2	2
111	-	-	-	-	-	-	-	-	-	-	2	2
112	-	-	-	-	-	-	-	-	-	-	1	1
113	-	-	-	-	-	-	-	-	-	-	3	3
TOTAL	58	18	76	229	29	259	28	2	30	982	2057	3055

Appendix 2 table 2. Length frequencies of tagged lingcod released in the Stuart Island area during 1982-83.

Area Fork length (cm)	M	F	T
39	-	-	1
40	-	-	0
41	-	-	0
42	1	-	1
43	0	-	0
44	0	-	0
45	1	-	1
46	2	-	2
47	2	-	2
48	0	3	3
49	3	2	5
50	8	2	10
51	10	1	11
52	7	5	12
53	9	11	20
54	5	8	13
55	8	11	19
56	11	6	17
57	3	12	15
58	5	10	15
59	4	12	16
60	5	6	11
61	3	10	13
62	4	6	10
63	4	3	7
64	6	2	8
65	1	5	6
66	4	4	8
67	1	3	4
68	6	1	7
69	5	1	6
70	3	2	5
71	2	4	6
72	4	3	7
73	1	4	5
74	0	2	2
75	0	0	0
76	0	3	3
77	1	5	6
78	2	3	5
79	2	1	3
80	-	3	3
81	-	2	2

Appendix 2 table 2 (cont'd)

Area Fork length (cm)	M	F	T
82	-	2	2
83	-	2	2
84	-	2	2
85	-	1	1
86	-	0	0
87	-	1	1
88	-	0	0
89	-	1	1
90	-	0	0
91	-	0	0
92	-	1	1
93	-	0	0
94	-	1	1
95	-	0	0
96	-	1	1
97	-	0	0
98	-	0	0
99	-	1	1
100	-	1	1
101	-	1	1
102	-	0	0
103	-	0	0
104	-	0	0
105	-	0	0
106	-	1	1
TOTAL	1133	172	306

Appendix 2 table 3. Length frequencies of tagged lingcod released in the Pender Harbour area during 1982-83.

Area Fork length (cm)	Nearshore (< 30 m) length			Deep Reef (≥ 30 m)			TOTAL		
	M	F	T	M	F	T	M	F	T
41	2	1	3	-	-	-	2	1	3
42	0	2	2	-	-	-	0	2	2
43	1	1	2	-	-	-	1	1	2
44	4	0	4	-	-	-	4	0	4
45	2	0	2	-	-	-	2	0	2
46	7	1	8	-	-	-	7	1	8
47	17	1	18	-	-	-	17	1	18
48	13	1	14	-	-	-	13	1	14
49	13	1	14	1	-	1	14	1	15
50	18	3	21	1	-	1	19	3	22
51	27	5	32	0	1	1	27	6	33
52	25	11	36	0	0	0	25	11	36
53	29	6	35	0	1	1	29	7	36
54	23	4	27	2	1	3	25	5	30
55	16	5	22	2	0	2	18	5	24
56	21	10	31	1	0	1	22	10	32
57	15	4	19	1	0	1	16	4	20
58	9	7	16	2	1	3	11	8	19
59	8	1	9	0	0	0	8	1	9
60	12	2	14	2	0	2	14	2	16
61	8	3	11	0	0	0	8	3	11
62	6	5	11	0	0	0	6	5	11
63	1	0	1	0	0	0	1	0	1
64	7	2	9	1	0	1	8	2	10
65	8	1	9	0	0	0	8	1	9
66	4	2	6	0	0	0	4	2	6
67	6	4	10	1	0	1	7	4	11
68	4	0	4	1	0	1	5	0	5
69	13	2	15	1	1	2	14	3	17
70	3	5	8	1	1	2	4	6	10
71	5	3	8	0	0	0	5	3	8
72	6	3	9	1	0	1	7	3	10
73	4	2	6	1	0	1	5	2	7
74	2	2	4	1	0	1	3	2	5
75	5	1	6	0	2	2	5	3	8
76	3	0	3	1	1	2	4	1	5
77	7	2	9	1	1	2	8	3	11
78	3	2	5	0	1	1	3	3	6
79	5	1	6	0	0	0	5	1	6
80	3	5	8	1	4	5	4	9	13
81	1	2	3	1	4	5	2	6	8
82	3	2	5	-	0	0	3	2	5
83	3	3	6	-	3	3	3	6	9

Appendix 2 table 3 (cont'd)

Area Fork length (cm)	Nearshore (< 30 m)			Deep Reef (≥ 30 m)			TOTAL		
	M	F	T	M	F	T	M	F	T
84	1	0	1	-	3	3	1	3	4
85	2	4	6	-	1	1	2	5	7
86	0	4	4	-	2	2	0	6	6
87	2	3	5	-	1	1	2	4	6
88	1	1	2	-	2	2	1	3	4
89	-	2	2	-	3	3	-	5	5
90	-	3	3	-	4	4	-	7	7
91	-	0	0	-	2	2	-	2	2
92	-	4	4	-	3	3	-	7	7
93	-	0	0	-	4	4	-	4	4
94	-	1	1	-	5	5	-	6	6
95	-	1	1	-	2	2	-	3	3
96	-	2	2	-	2	2	-	4	4
97	-	0	0	-	1	1	-	1	1
98	-	0	0	-	4	4	-	4	4
99	-	1	1	-	2	2	-	3	3
100	-	3	3	-	2	2	-	5	5
101	-	2	2	-	0	0	-	2	2
102	-	0	0	-	1	1	-	1	1
103	-	1	1	-	1	1	-	2	2
104	-	0	0	-	2	2	-	2	2
105	-	0	0	-	1	1	-	1	1
106	-	1	1	-	2	2	-	3	3
107	-	2	2	-	1	1	-	3	3
108	-	0	0	-	0	0	-	0	0
109	-	0	0	-	1	1	-	1	1
110	-	2	2	-	1	1	-	3	3
111	-	-	-	-	0	0	-	0	0
112	-	-	-	-	1	1	-	1	1
TOTAL	378	155	534	24	76	100	402	231	634

Appendix 3. Procedures for estimating abundance of lingcod in the Campbell River area south of Discovery Passage, from tag releases and recoveries during the 1982-83 tagging period.

Schumacher and Eschmeyer (1943)

Abundance was estimated using the following formula:

$$\frac{1}{N} = \frac{\Sigma(M_t R_t)}{\Sigma({}_t M_t{}^2)}$$

where

N = abundance
M_t = the number of tagged fish at large in time t.
R_t = the number of tagged recoveries made in time t.
C_t the number of tagged and untagged lingcod caught at time t.

Cast in this manner, 1/N is equal to the slope of the regression of R_t/C_t on M_t. The variance (S^2) of N is the mean of the squares of deviations from the regression whereby;

$$S^2 = \frac{\Sigma(R^2{}_t/C_t) - (\Sigma R_t M_t)^2/\Sigma(C_t M_t{}^2)}{m-1}$$

where m = the number of 5d tagging intervals examined.

Confidence limits (95%) were estimated for 1/N by multiplying the appropriate t-values, using m-1 degrees of freedom, times the standard error (S.E.) where;

$$S.E. = \frac{\sqrt{S^2}}{C_t M_t{}^2}$$

The 95% confidence limits for N were then found by inverting those estimated for 1/N.

Appendix 3 (cont'd)

Schnabel (1938)

An approximation to the maximum likelihood estimate of N is given by the formula;

$$N = \frac{\Sigma(C_t M_t)}{\Sigma R_t}$$

The variance of 1/N is equal to $\frac{\Sigma R_t}{(\Sigma C_t M_t)^2}$.

From the standard error $(\frac{\sqrt{\Sigma R_t}}{(\Sigma C_t m_t)^2})$ 95% confidence limits were calculated for 1/N using the appropriate t-values.

The computations necessary for Schumacher and Eschmeyer and Schnabel estimates are presented below:

A. Males

Tagging interval (5 d)	C_t	R_t	M_t	$C_t M_t$	$M_t R_t$	$C_t M_t^2$	R_t^2/C_t
1	15	0	0	0	0	0	0.00
2	28	0	15	420	0	6300	0.00
3	92	2	43	3956	86	170108	0.04
4	70	4	133	9310	532	1238229	0.23
5	200	9	199	39800	1791	7920201	0.40
6	137	5	390	53430	1950	20837708	0.18
7	25	1	522	13050	522	6812099	0.04
8	20	2	546	10920	1092	5962320	0.20
9	3	0	564	1692	0	954288	0.00
10	4	0	567	2268	0	1285856	0.00
11	2	0	571	1142	0	652082	0.00
12	14	2	573	8022	1146	4596608	0.29
13	14	1	585	8190	585	4791152	0.07
14	37	3	598	22126	1794	13231353	0.24
15	42	7	632	26544	4424	16775803	1.17
Total	703	36	5938	200870	13922	85234208	2.87

Appendix 3 (cont'd)

B. Females

Tagging interval (5 d)	C_t	R_t	M_t	C_tM_t	M_tR_t	$C_tM_t^2$	R_t^2/C_t
1	72	0	0	0	0	0	0.00
2	79	1	72	5688	72	409536	0.01
3	163	5	150	24450	750	3667501	0.15
4	93	9	308	28644	2772	8822350	0.87
5	115	14	392	45080	5488	17671366	1.70
6	71	11	493	35003	5423	17256476	1.70
7	146	15	553	80738	8295	44648128	1.54
8	97	14	684	66348	9576	45382032	2.02
9	242	22	767	185614	16874	142365872	2.00
10	192	23	987	189504	22701	187040432	2.76
11	107	18	1156	123692	20808	142987936	3.03
12	225	35	1247	280575	43645	349877184	5.44
13	222	36	1435	318570	51660	457147776	5.84
14	292	55	1621	473332	89155	767271232	10.36
15	199	49	1771	352429	86779	624151680	12.07
Total	2315	307	11636	2209667	363998	2808699648	49.50

C. Total

Tagging interval (5 d)	C_t	R_t	M_t	C_tM_t	M_tR_t	$C_tM_t^2$	R_t^2/C_t
1	87	0	0	0	0	0	0.00
2	107	1	87	9309	87	809883	0.01
3	255	7	193	49215	1351	9498493	0.19
4	163	13	441	71883	5733	31700414	1.04
5	315	23	591	186165	13593	110023496	1.68
6	208	16	883	183664	14128	162175312	1.23
7	171	16	1075	183825	17200	197611840	1.50
8	117	16	1230	143910	19680	177009296	2.19
9	245	22	1331	326095	29282	434032608	1.98
10	196	23	1554	304584	35742	473323552	2.70
11	109	18	1727	188243	31086	325095680	2.97
12	239	37	1820	434980	67340	791663616	5.73
13	236	37	2020	476720	74740	962974272	5.80
14	329	58	2219	730051	128702	1619983488	10.22
15	241	56	2403	579123	134568	1391633024	13.01
Total	3018	343	17574	3867767	573232	667535104	50.25